REMARKS

Claims 1-7 are pending in the application and stand rejected.

Claims 1, 3, and 4 have been amended herein. No new matter is added by the claim amendments. The amendments are fully supported by the original disclosure, e.g., the drawings at Fig. 5 (pitch Lx) and Figs. 4 and 6 (Lx/λ ordinate values); the specification at Page 13, lines 2-25 and Page 15, lines 3-12. Applicant respectfully requests entry and consideration of the claim amendments.

Claims 1, 2, 5, and 6 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,422,756 to Weber.

Referring to Claim 1, Weber does not disclose, inter alia, the subject matter set forth by the recitation of "at least one of said layers having a variable thickness." The Weber disclosure relied upon by the Examiner teaches that one layer may have a thickness that is different (i.e., varied) from another layer, but not that the layer itself has a variable thickness. Instead, the individual Weber layers are uniform in thickness (though different from one another) and hence do not have a variable thickness.

In the claims, the "variable thickness" recitation applies to the thickness specification of a layer, not that the thickness of one layer is different (i.e., variable) from the thickness of another layer.

The variable thickness feature of the claims is illustrated in Fig. 5 of the application at layer 7 (SiO_2) and layer 8 (Si), i.e., variable thickness "t". ("This polarizer has the structure in which SiO_2 and Si layers are regularly bent changing the thickness of the SiO_2 layer between 0.9 Lz and 0.3 Lz, and changing the thickness of Si layer between 0.1 Lz and 0.7 Lz."; Page 14, lines

5-15 of specification filed 7 February 2001.) As shown, the thickness "t" of an individual layer 7, 8 varies along the x-direction. For comparison purposes, note the variable thickness "t" of Fig. 5 compared to the constant thickness "t" of Fig. 1.

The rejection reads in relevant part:

> With regard to claim 1, Weber discloses (please see Figs. 1 & 2) the invention as claimed, a polarizer [10 in Fig. 1, ...] comprising: ... wherein at least one of said layers has a variable thickness [please see column 4, lines 4-9], ...

Weber discloses as follows in relevant part, including the disclosure cited and relied upon by the Examiner (emphasis added):

> In general, more layers are used, such as a $(HL)^5$ stack, and generally the average optical thickness of each material is a quarterwave thick, with reference to a chosen wavelength of interest (typically but not necessarily in the visible spectrum). <u>However, to optimize performance, the individual thicknesses of all thin film layers are varied slightly from the average thickness</u>, in accordance with known principles, using commercially available software to calculate the desired values. (Col. 3, line 68 to Col. 4, line 9.)

> In Example 1, the polarizer had three optical stacks, each having twelve layers, either silicon dioxide (SiO_2) or titanium dioxide (TiO_2). The unusually high number of layers was required because the PACVD technique as described above did not produce a uniform film thickness near the prism peaks as opposed to the bottoms of the grooves. The first stack had a quarterwave thickness centered at 400 nm, the next centered at 550 nm, the third centered at 700 nm. (Col. 7, lines 24-32.)

However, the Weber statement that "the individual thicknesses of all thin film layers are varied slightly from the average thickness" does not mean that the layer <u>itself</u> has a variable thickness, such as with layers 7, 8 in Fig. 5 of the application. Rather, Weber is simply stating that the layer itself, as a whole, may be provided with a thickness that is different than the average thickness, or that the (uniform) thickness of one layer may be different than the (uniform)

thickness of another layer. The thickness of each individual layer, though, is uniform and not variable in Weber.

This interpretation of the cited Weber disclosure is borne out in the passage noted above at Col. 7, lines 24-32. In order to accommodate different light wavelengths (e.g., 400, 550, and 700 nm), the individual optical stacks of Weber are prepared with the appropriate (constant) thickness. However, although one stack (layer) may have a different thickness than another stack (layer), each stack (layer) itself has a uniform thickness, not a variable thickness as in the claims. According to Weber, the varied "<u>individual</u> thicknesses" refers to a layer of uniform thickness having a thickness that is different (i.e., varied) from another layer (of uniform thickness), not that the layer itself has a variable thickness, as in the claims.

In view of the foregoing, Applicant respectfully submits that Claim 1 and Claims 2, 5, and 6 dependent therefrom are patentable over Weber and requests that this rejection be withdrawn.

Applicant further notes the following Weber disclosure:

> Optionally, ... a birefringent material may be included in the system. (Abstract.)
>
> A suitable alternative method of depolarizing light consists of passing the light through a highly birefringent plate such as a sheet of polyester. As shown in FIG. 6, polarized light of certain wavelengths, as indicated by the peaks of the curve 600 corresponding to odd multiples of a basic quarter-wavelength, is transmitted by a crossed second polarizer after passing through a 0.1016 mm (0.004 inch) thick sheet of oriented polyester. (Col. 9, lines 5-13).
>
> With this method, the birefringent plate is used in place of diffuser 330. (Col. 9, lines 34-35.)
>
> This method can be combined with another technique. If the birefringent plate varies in optical thickness across its face, such that various rays of light directed

> to a given LCD pixel area have all seen a different magnitude of birefringence, the light will be effectively depolarized. (Col. 9, lines 40-45.)

However, the foregoing disclosure -- "If the birefringent plate varies in optical thickness across its face" -- applies only to the specified birefringent plate, and therefore has no application to the relevant Weber structure cited and relied upon by the Examiner, namely, the retroreflecting polarizer 10 of Figs. 1 and 2.

Separately, and notwithstanding the above, Applicant submits that Claim 1 (as amended) is not taught by Weber. Claim 1 (as amended) reads as follows in relevant part:

> ... at least one of said layers having a <u>periodic</u> variable thickness <u>with a periodicity along a direction orthogonal to a direction of light incident upon said multilayered structure that is equal to or less than a wavelength of the incident light</u>, ...

As discussed below, this feature concerning the periodicity of the variable thickness is neither taught nor suggested by Weber.

The difference in structure between Weber and the invention -- and specifically the lack of disclosure in Weber concerning not only the variable layer thickness but also the periodicity of the variable thickness ("periodicity along a direction orthogonal to a direction of light incident upon said multilayered structure that is equal to or less than a wavelength of the incident light") -- is evident from the different transmittance characteristics.

In Weber, diffraction appears along the light propagating (and transmittance) dimension described in Weber (i.e., direction of incident light 18 in Fig. 1). Therefore, even if light is introduced into the Weber film vertically, there is a loss due to a diffracted light component, apart from the transmitted light component (18-p) and reflected light component (18-s). (Fig. 2.) For example, as seen in Fig. 6, the transmittance is approximately 80%, where the remainder is

ostensibly lost due to diffraction. ("Transmissivity of the p-polarization component, T(p), was very acceptable, nearly 80% or more throughout the visible spectrum." at Col. 7, lines 37-39.)

However, in the invention, the diffracted light is not generated (at least not to the same extent as Weber), if the period in the lateral direction (i.e., Lx) for the variability of the layer thickness is set at a wavelength or less, as set forth in amended Claim 1. Therefore, in the invention, near 100% transmittance can be obtained in principle by optimizing the design of the film thickness in this manner. (Page 12, lines 21-26; Page 13, lines 20-21; Fig. 3.)

Claims 3, 4, and 7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,422,756 to Weber in view of U.S. Patent No. 6,111,697 to Merrill et al.

Applicant respectfully submits that Claims 3, 4, and 7 are patentable over Weber in view of Merrill et al. for reasons similar to those presented above concerning the patentability of Claims 1, 2, 5, and 6 over Weber. The noted deficiencies of Weber are not cured or overcome by the teachings of Merrill et al. Accordingly, Applicant respectfully requests that this rejection be withdrawn.

Applicant believes that the application is in condition for allowance and respectfully requests favorable action in accordance therewith.

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If the Examiner has any questions or comments that would advance prosecution of this case, the Examiner is invited to call the undersigned at 260/484-4526.

Respectfully Submitted,

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RJK/*

Enclosures: Amendments to the Claims
(4 Sheets)
Explanatory Cover Sheet - Page 1
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I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, PO Box 1450, Alexandria, VA 22313-1450, on: July 15, 2005.

Randall J. Knuth, Registration No. 34,644

July 15, 2005
Date

AMENDMENTS TO THE CLAIMS

Claim 1 (currently amended): A polarizer comprising:

a multilayered structure having two or more transparent layers disposed along a z-axis of a three-dimensional orthogonal coordinate system (x, y, z) associated with the polarizer, at least two said layers having different refractive indices relative to one another,

each said layer having a shape, each said layer being a unit of lamination, the shape of each said layer being in a form of an undulated structure, said undulated structure consisting of a set of co-directed undulations, said undulated structure being a regularly or non-regularly undulated structure, at least one of said layers having a periodic variable thickness with a periodicity along a direction orthogonal to a direction of light incident upon said multilayered structure that is equal to or less than a wavelength of the incident light,

the lamination along the z-axis repeating the shape and being configured to polarize light incident upon said multilayered structure.

Claim 2 (previously presented): The polarizer according to claim 1, wherein the polarizer has a first refractive medium layer containing at least one of Si and TiO_2 as a main component

and a second refractive medium layer containing SiO_2 as a main component.

Claim 3 (currently amended): A method for producing a polarizer comprising the steps of:

laminating on a substrate a first refractive medium layer and a second refractive medium layer with a regularly repeating shape, at least one of said first medium layer and said second medium layer having a periodic variable thickness with a periodicity along a direction orthogonal to a direction of light incident upon said polarizer that is equal to or less than a wavelength of the incident light, said laminating performed by a film-forming method at least partly including a step of sputter etching said first refractive medium layer and said second refractive medium layer, said substrate having at most one of each of a single set of regularly arranged, co-directed grooves, a single set of regularly arranged, co-directed projections, a single set of non-intersecting projections, and a single set of co-directed, non-intersecting grooves.

Claim 4 (currently amended): A method of producing a polarizer, comprising the steps of:

laminating on a substrate a first refractive medium layer which contains at least one of Si and TiO_2 as a main component

and a second refractive medium layer which contains SiO_2 as a main component with a regularly repeating shape, at least one of said first medium layer and said second medium layer having a periodic variable thickness with a periodicity along a direction orthogonal to a direction of light incident upon said polarizer that is equal to or less than a wavelength of the incident light, said laminating performed by a film-forming method at least partly including a step of sputter etching said first refractive medium layer and said second refractive medium layer, said substrate having at most one of each of a single set of regularly arranged, co-directed grooves, a single set of regularly arranged, co-directed projections, a single set of non-intersecting projections, and a single set of co-directed non-intersecting grooves.

Claim 5 (previously presented): The polarizer according to claim 1, wherein the respective shape of at least one of said layers having a regularly undulated structure along the x-axis and being uniform along a y-axis.

Claim 6 (previously presented): The polarizer according to claim 1, wherein said first refractive medium layer has a first index of refraction, said second refractive medium layer has a

second index of refraction, said first index of refraction being greater than said second index of refraction.

Claim 7 (previously presented): The method for producing a polarizer according to claim 3, wherein said substrate has at least one of said thin and long projections and said thin and long grooves.